## REMARKS

Applicants have studied the Office Action dated October 4, 2004. It is submitted that the application, as amended, is now in condition for allowance. Claims 1-21 are pending. Claims 1, 16, and 21 have been amended. Reconsideration and allowance of the pending claims in view of the above amendments and the following remarks is respectfully requested.

In the Office Action, the Examiner:

(1) objected to claim 21 for informalities; and

(2-3) rejected claims 1-21 under 35 U.S.C.§ 102(e) as being anticipated by Wienand et al. (U.S. Patent No. 6,787,870).

### (1) Objection to Claim 21

As noted above, the Examiner objected to claim 21 for informalities. Specifically, claim 21, as originally submitted, recited the limitation "adjacent to insulating-insulating layer." As suggested by the Examiner on page 2 of the Office action, the language of claim 21 has been amended to now recite "adjacent to the electrical-insulating layer." It is believed that amended claim 21, in light of the further amendments explained below, is now in condition for allowance.

### (2-3) Rejection under 35 U.S.C. § 102(e) Wienand et al.

As noted above, the Examiner rejected claims 1-21 under 35 U.S.C. § 102(e) as being anticipated by Wienand et al. (U.S. Patent No. 6,787,870). Independent claims 1, 16, and 21 have been amended to distinguish and to more clearly define the present invention over Wienand et al. Support for the changes is found on page 12, paragraph 0042, in the specification as originally filed. No new matter has been added.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful. Amended independent claim 1 recites, *inter alia*:

... a plurality of thermal sensors directly patterned on the electrical-

> insulating layer, each of the plurality of thermal sensors in a different location, wherein the plurality of thermal sensors are located within one or more thin film circuit layers disposed on the electrical-insulating layer. (emphasis added).

In the present invention, as stated in amended claim 1 and explained in paragraphs 0036, 0042, and 0044 of the application as filed, state-of-the-art thin-film deposition techniques or photolithography is used to pattern temperature sensors directly on the electrical insulating layer, which is formed directly on the heat sink. The resulting thickness of the circuitry and thermal sensors is very thin—between 10 nm to 5 microns, as recited in the instant application in Claims 14 and 20. As a result, the low profile sensors do not affect the heat flow pattern of the real cooling package. In addition, since each sensor is patterned directly on the electrical insulating layer using well-defined processes, their thermal impedance/resistance is well defined. Consequently, the sensor can be actually used to derive the corresponding heat flux pattern.

The physical composition of the present invention is clearly shown in FIGs. 2 and 4 of the application as filed, where the thermal sensors 210, 211, and 212 are directly patterned on a surface of the electronic-insulation layer 203 facing away from the heat sink 202. *See also* paras. 0042 and 0044 of the instant application.

The Wienand et al. reference discloses a thin-film resistive sensor thermally connected to a heat sink and a semiconductor component. The thin-film resistive sensor (7), can be seen in FIG. 1b of Wienand et al. placed within a thermally conductive electrically-insulating layer (5). Importantly, the sensor (7) of Wienand et al. is not "patterned on the electrically insulating layer," as are the sensors of the instant application.

The thin-film resistive thermal sensor (7) of Wienand et al. is a measuring resistor (15) applied to a foil (16) with an electrically insulating layer (17) situated between the foil (16) and the measuring resistor (15). Col. 4, lines 4-12. It should be noted that Wienand et al. do not at all disclose using thermocouples as temperature sensors as does the instant application. *See* Paras. 0039-0046 of the instant application. Thermo

couples are known to provide several advantages over thermal resistors. One advantage is thermocouples provide more accurate temperature measurements. Another advantage is that thermocouples require fewer wires to be connected.

Furthermore, the resulting structure as taught by Wienand et al. is no different than putting small resistors into the thermal interface material between the heatsink and chip, which is known in the art. These thermal resistors are a separate component inside the thermal interface between the heatsink and the chip. The use of separate thermal resistor components results in less meaningful temperature measurements because it depends on various details of the thermal coupling of the sensors to the heatsink, chip and thermal interface material

Because the "thin film resistors" of Wienand et al. are not patterned directly on the insulation layer, the thin film resistor sensors are not at all the same as the thin film resistors disclosed as one embodiment of the instant application. Para. 0050 and claims 8-11, 19, and 20 of the instant application. The thickness of the thermal sensors used in Wienand et al. is quite large—10-100μm (Wienand et al., col. 2, lines 25-31)—compared to thermal sensors of between 10 nm to 5 microns, as recited in claims 14 and 20 of the instant application. *See also* Paras. 0050 and 0051 of the instant application. Consequently, the heat flow pattern of the Wienand et al. device is negatively affected by the large size sensors. Conversely, the thermal resistance of each small thermal sensor in the present invention, patterned directly on the electrical insulating layer by state-of-the-art thin-film deposition techniques or photolithography, is well defined and provides a key advantage over Wienand et al. *See* Para. 0036 of the instant application.

The Examiner cites 35 U.S.C. § 102(e) and a proper rejection requires that a single reference teach (i.e., identically describe) each and every element of the rejected claims as being anticipated by Wienand et al.[1] By virtue of this amendment,

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[1] See MPEP §2131 (Emphasis Added) "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The

independent claims 16 and 21 have been amended to contain the same limitations of independent claim 1. Because the elements in independent claims 1, 16 and 21 (at least "a plurality of thermal sensors directly patterned on the electrical-insulating layer") of the instant application is not taught or disclosed by Wienand et al., the apparatus of Wienand et al. does not anticipate the present invention. The dependent claims are believed to be patentable as well because they all are ultimately dependent on either claim 1 or claim 16. Accordingly, the present invention distinguishes over Wienand et al. for at least this reason. The Applicants respectfully submitted that the Examiner's rejection under 35 U.S.C. § 102(e) has been overcome.

## CONCLUSION

The remaining cited references have been reviewed and are not believed to affect the patentability of the claims as amended.

In this Response, Applicants have amended certain claims. In light of the Office Action, Applicants believe these amendments serve a useful clarification purpose, and are desirable for clarification purposes, independent of patentability. Accordingly, Applicants respectfully submit that the claim amendments do not limit the range of any permissible equivalents.

Applicants acknowledge the continuing duty of candor and good faith to disclosure of information known to be material to the examination of this application. In accordance with 37 CFR §1.56, all such information is dutifully made of record. The foreseeable equivalents of any territory surrendered by amendment are limited to the territory taught by the information of record. No other territory afforded by the doctrine of equivalents is knowingly surrendered and everything else is unforeseeable at the time of this amendment by the Applicants and their attorneys.

Applicants respectfully submit that all of the grounds for rejection stated in the

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Identical invention must be shown in as complete detail as is contained in the ... claim."

Examiner's Office Action have been overcome, and that all claims in the application are allowable. No new matter has been added. It is believed that the application is now in condition for allowance, which allowance is respectfully requested.

It is believed that no fee is due with this Amendment. However, if any fees are due, the Commissioner is hereby authorized to charge any fees that may be required or credit any overpayment to Deposit Account 50-0510.

**PLEASE CALL** the undersigned if that would expedite the prosecution of this application.

Respectfully submitted,

Date: January 4, 2005

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